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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/614,787

07/09/2003

Qi Qiu

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01/27/2005

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EXAMINER

SONG, HOON K

ART UNIT

PAPER NUMBER

2882

DATE MAILED: 01/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/614,787

Applicant(s)

QIU ET AL.

Examiner

Hoon Song

Art Unit

2882

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-33 and 43-56 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 34-42 and 57-65 is/are allowed.
- 6) ☒ Claim(s) 1-23, 25-33, 43-53, 55 and 56 is/are rejected.
- 7) ☒ Claim(s) 24 and 54 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>1/7/2004</u> . | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2 are rejected under 35 U.S.C. 102(b) as being anticipated by
Keesmann (US 5773921).

Regarding claim 1, Keesmann teaches an x-ray generating device for scanning
an object under inspection comprising:

at least one addressable field emission cathode (figure 5, column 6 lines 7-16
and 32-39), the cathode comprising a substrate and a nanostructure-containing material
comprising carbon nanotubes (column 7 line 7 and 15-17);
and

at least one anode target (see column 7 line 16, the x-ray tube would necessarily
include an anode target).

Regarding claim 2, Keesmann teach the nanostructure-containing material
comprises single-walled carbon nanotubes, multi-wall nanotubes, or mixtures thereof
(column 3 line 14).

Claims 1, 3-5, 7-9, 11-13, 15-23, 25-33, 43-51, 53 and 55-56 are rejected under 35 U.S.C. 102(e) as being anticipated by Whitlock et al. (US 6333968B1).

Regarding claim 1, Whitlock teaches an x-ray generating device for scanning an object under inspection comprising:

at least one addressable field emission cathode, the cathode comprising a substrate and a nanostructure-containing material comprising carbon nanotubes (column 4 line 8 and column 7 line 21); and

at least one anode target (303).

Regarding claim 3, Whitlock teaches the cathode comprises a substrate material (306) is at least partially covered with the nanostructure-containing material coating layer (298) (figure 11).

Regarding claim 4, Whitlock teaches an adhesion-promoting interlayer (SiO₂ conductive layer) between the substrate (306) and the nanostructure-containing material coating layer (298) (figure 11).

Regarding claim 5, Whitlock teaches a gate electrode (column 17 line 2).

Regarding claim 7, Whitlock teaches the device is portable (figure 7).

Regarding claim 8, Whitlock teaches the cathode comprises an array of nanostructure containing material elements, each of the nanostructure containing elements being individually addressable (column 15 line 21 and column 4 line 8).

Regarding claim 9, Whitlock teaches the at least one cathode and the at least one anode are contained within a vacuum chamber (figure 7).

Regarding claim 11, Whitlock teaches the cathode emits electrons without the assistance of the heater (figure 11, cold cathodes).

Regarding claim 12, Whitlock teaches a multi-beam x-ray generating device comprising:

a stationary field-emission cathode comprising a plurality of stationary and individually controllable electron-emitting pixels (94) disposed in a predetermined pattern on the cathode (figure 4, column 7 line 21);

an anode (108) opposing the cathode (92) comprising a plurality of focal spots (114) disposed in a predetermined pattern (figure 4) that corresponds to the predetermined pattern of the pixel (figures 4, 5a); and

a vacuum chamber enveloping the anode and cathode (column 8 line 63).

Regarding claim 13, Whitlock teaches the cathode comprises a nanostructure-containing material (column 4 line 8).

Regarding claim 15, Whitlock teaches the cathode has a planar geometry (figures 4, 5a).

Regarding claim 16, Whitlock teaches the anode has a planar geometry (figures 4, 5a).

Regarding claim 17, Whitlock teaches at least one gate electrode (406) arranged to control the field-emission cathode.

Regarding claim 18, Whitlock teaches the at least one gate electrode comprises a plurality of individually addressable gate electrode control units (136), each unit arranged to control a corresponding electron-emitting pixel (column 7 line 20).

Regarding claim 19, Whitlock teaches the focal spots comprise materials that produce x-rays with different energy distributions when bombarded with electrons emitted from the pixels (column 9 line 51).

Regarding claim 20, Whitlock teaches one focal spot for every pixel (figures 4, 5a).

Regarding claim 21, Whitlock teaches a computer (136) programmed to control the plurality of pixels.

Regarding claim 22, Whitlock teaches the computer is programmed to turn on the pixels in sequence, at a predetermined frequency, for a predetermined duty cycle, and/or for a predetermined dwell time (column 9 line 67).

Regarding claim 23, Whitlock teaches the pixels and corresponding focal spots are arranged along the circumference of a circle (figure 7).

Regarding claim 25, Whitlock teaches the pixels and corresponding focal spots are arranged along the circumferences of a plurality of concentric circles (figure 7).

Regarding claim 26, Whitlock teaches the pixels are arranged in at least one cluster, the at least one cluster comprising a plurality of immediately adjacent pixels (figure 5a).

Regarding claim 27, Whitlock teaches each pixel comprises a multi-layer electrical gate (grid, deflector) or coil constructed to focus a beam of electrons emitted from each pixel (figure 10).

Regarding claim 28, Whitlock teaches a collimator (195) constructed to focus the x-ray beams generated by the focal spots

Regarding claim 29, Whitlock teaches an x-ray detector (196).

Regarding claim 30, Whitlock teaches the detector comprises a plurality of discrete detector elements (254, area detector).

Regarding claim 31, Whitlock teaches the detector comprises a matrix of detector pixels (area image detector, 196, 254).

Regarding claim 32, Whitlock teaches computer hardware (168) and software for collecting input from the detector, and constructing an image from the input.

Regarding claim 33, Whitlock teaches a monitor (172) for displaying the image.

Regarding claim 43, Whitlock teaches a method of scanning an object with x-rays directed at the object from different locations, the method comprising:

- (i) providing a stationary field-emission cathode comprising a plurality of stationary and individually controllable electron-emitting pixels (117) and disposing the pixels in a predetermined pattern on the cathode (figure 5a, 7 and 8);

- (ii) locating an anode (134) in opposing relationship to the cathode and providing the anode with a plurality of focal spots (118) disposed in a predetermined pattern that corresponds to the predetermined pattern of the pixels;

- (iii) enveloping the anode and cathode with a vacuum chamber (52); and

- (iv) activating at least one of the pixels thereby generating a beam of emitted electrons that is incident upon a corresponding focal spot of the anode (column 7 line 20), thereby generating an x-ray (124), and directing the x-ray toward the object (122) to be scanned (figure 5a).

Regarding claim 44, Whitlock teaches step (iv) comprises activating a first pixel (128) thereby generating a first x-ray incident upon the object to be scanned from a first location, then sequentially activating at least a second pixel thereby generating a second x-ray incident upon the object to be scanned from a second location (column 9 line 50-53).

Regarding claim 45, Whitlock teaches step (iv) comprises simultaneously activating a plurality of pixels thereby generating a plurality of x-rays incident upon the object to be scanned from multiple locations (column 9 line 46 teaches a plurality of pixels turn "ON" at same time).

Regarding claim 46, Whitlock teaches the step of:

(v) locating an x-ray detector such that x-rays passing through the object (262) being scanned are incident up the detector (254).

Regarding claim 47, Whitlock teaches the detector comprises a plurality of discrete detectors (254, area image detector comprises a plurality of pixel of detectors).

Regarding claim 48, Whitlock teaches the detector comprises a plurality of detector pixels (254, area image detector).

Regarding claim 49, Whitlock teaches the step of:

(vi) collecting input from the detector (254) and constructing an image from the input (figure 8).

Regarding claim 50, Whitlock teaches the step of:

(vii) displaying (172) the constructed image.

Regarding claim 51, Whitlock teaches the cathode comprises a nanostructure-containing material (column 4 line 8).

Regarding claim 53, Whitlock teaches steps (i) and (ii) comprise arranging the pixels and corresponding focal spots along the circumference of a circle (figure 7).

Regarding claim 55, Whitlock teaches steps (i) and (ii) comprise arranging the pixels along the circumferences of a plurality of concentric circles (figure 7).

Regarding claim 56, Whitlock teaches step (i) comprises arranging the pixels in at least one cluster, the at least one cluster comprising a plurality of immediately adjacent pixels (figure 5a).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Whitlock in view of Horbaschek (US 4712226).

Regarding claim 6, Whitlock fails to teach a plurality of anode target.

Horbaschek teaches an x-ray source having a plurality of anode target (figure 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention to adapt the x-ray source of Whitlock with the plurality of targets as taught by Horbaschek, since the plurality of targets would allow one to generate x-ray beams of different energies using a single x-ray source.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Whitlock in view of Kawahara (US 6028911).

Regarding claim 10, Whitlock fails to teach a moveable stage.

Kawahara teaches a movable stage (22).

It would have been obvious to one of ordinary skill in the art at the time of the invention to adapt the x-ray system of Whitlock with the movable stage as taught by Kawahara, since the movable stage would locate an examining object more accurately.

Claims 14 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Whitlock in view of Keesmann et al.

Regarding claim 14, Whitlock fails to teach the nanostructure-containing material comprises single walled carbon nanotubes.

Keesmann teaches that single-walled and multi-walled carbon nanotubes are interchangeable.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the nanotube cathodes of Whitlock with the single walled carbon nanotubes as taught by Keesman, since Keesman teaches that either single or multi-walled nanotube can be used. Thus, the selection of one over the other is considered to constitute an obvious matter of design base on manufacture preference and material availability.

Allowable Subject Matter

Claims 34-42 and 57-65 are allowed over prior art.

Claims 24 and 54 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The prior art fails to teach an field emissive cathode type x-ray generating device or method of scanning with the device having a gate electrode with a plurality of different sizes openings as claimed in claims 34, 24, 54 and 57.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hoon Song whose telephone number is (571) 272-2494. The examiner can normally be reached on 8:30 AM - 5 PM, Monday - Friday.

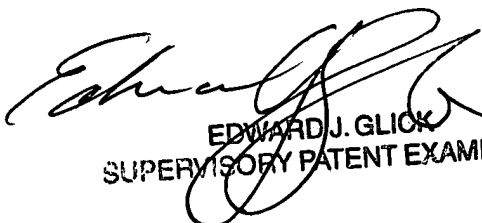
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (571) 272 - 2490. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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HKS


EDWARD J. GLICK
SUPERVISORY PATENT EXAMINER